

TECHNICAL DATASHEET #TDAX021500
HYDRAULIC FAN CONTROLLER

Application Platform
3 Temperature Sensors
4 Digital Command Interfaces
1 PWM Input and 1 Analog Input
1 Proportional or ON/OFF Current Output
RS232 Port
P/N: AX021500

Description:

The hydraulic fan controller provides precise, repeatable control of 1 proportional or on/off solenoid valve to adjust the speed of a hydraulic fan. Fan speed is inversely proportional to the current through the valve. Valve current control is based on up to three 2-wire temperature sensor inputs. An additional analog input can be used for an override input or other function. A +5V reference powers the override potentiometer. One digital input can be used as manual control input to allow the fan speed in this mode to be set by the Override Potentiometer or analog input. A PWM input is available for interface to an engine ECM (electronic control module) or PWM temperature sensor. Three digital inputs allow for speed advance, speed retard and fan reverse functions (or other functions). The robust design accepts 9...32V power supply input and is packaged in an IP67 rated housing with 24-pin connectors. The controller is designed for remote mounting. RS-232 port interfaces to PC with Tera Term freeware for user configuration and diagnostics. Other hydraulic control applications beyond fan controls can be accommodated with this hardware and application-specific software.



Applications include: Hydraulic Fan Drives; and Industrial and off-highway (mobile) applications for control of hydraulic valves.

Features:

- Independent output drives 1 solenoid valve (on/off or proportional)
- Up to 3 analog temperature sensor inputs with +5V reference power
- One PWM input interfaces to an ECM or PWM temperature sensor
- Three active low digital inputs (interface to switches, fan reverse and other fan control commands, etc.)
- One digital input can be used as manual control input to allow the fan speed in this mode to be set by the Override Potentiometer or analog input.
- Universal analog input (0-5V, 0-10V, 4-20 mA, 0-20 mA)
- +5V reference can power a potentiometer
- Interfaces to a 9...32VDC power supply with reverse polarity protection
- Thermal overload and overvoltage protection provided
- User configurability is provided within factory preset ranges based on the application
- Rugged IP67 rated packaging with plug-in connections
- Operational from -40 to 85°C (-40 to 185°F)
- RS232 interface to PC or laptop for user configuration and diagnostics

Ordering Part Numbers:

Controller: **AX021500**

(For application-specific s/w please contact Axiomatic for a part number.)

Accessories:

AX070000 Mating Plug Kit with DB-9

Technical Specifications:

The specifications represent a particular hardware platform. (Application-specific s/w will be provided on request).

Input Specifications

Power Supply Input - Nominal	12 or 24VDC nominal; 9...32 VDC power supply range
Reverse Polarity Protection	Provided
Analog Inputs	
<p>Delphi sensors are accepted (see Table 1). p/n 12146897 coolant/fluid temperature sensor p/n 12110446 sealed air temperature sensor p/n 121295956 exposed air temperature sensor</p> <p>The controller also accepts Honeywell NTC thermistors p/n 50006023-001 (see Table 2).</p> <p>The user may also select different sensors. Sensors with a linear response are preferred. Upon ordering, provide details of the selected sensors' specifications for factory programming the controller.</p>	
Temperature Sensor Inputs	3 temperature sensor inputs User specifies sensor, range of temperature control and setpoints
Sensors' Ground	Common ground connection provided.
Analog Input 1	0-5V, 0-10 VDC, 4-20 mA, 0-20 mA Option: 0.25 – 4.75 V potentiometer (5K to 10K) (software feature)
Analog Ground	Analog ground provided
PWM Input	
PWM Temperature Input	PWM pulse – normal/reverse polarity up to 3 kHz Adjustable from 0-100% Duty Cycle (5-95% default) For example, the controller could interface to a PWM signal from an engine ECM or an external PWM temperature sensor.
Digital Inputs	
<p>The controller accepts switched inputs or other digital inputs. For example, in a hydraulic fan drive application, digital inputs can be specified to perform these functions: fan direction CW/CCW, climate control ON/OFF, reduce flow (speed retard); speed advance. Fan reverse has an additional programmed parameter of hold time.</p>	
Digital Input 1	Active Low
Digital Input 2	Active Low
Digital Input 3	Active Low
Digital Input 4 MANUAL CONTROL	Manual Control (MC) Active Low The manual control input switches the controller into the manual control mode. The fan speed in this mode is set by the Override Potentiometer or analog input. If MC is active, the fan speed is determined ONLY by the Override Input. If MC is passive, the fan speed is determined by the temperature and PWM inputs.
Digital Ground	Common digital ground connection provided (shared as PWM input GND)

Table 1: Delphi Sensor Temperature vs. Output (Resistance) Table

Temp [Deg C]	Resistance [ohms]	Res [+/- %]	Ref Acc [+/- Deg C]	Temp [Deg C]	Resistance [ohms]	Res [+/- %]	Ref Acc [+/- Deg C]
20	3511	2.64	0.60	75	395	2.07	0.60
25	2795	2.50	0.60	80	334	2.04	0.60
30	2240	2.45	0.60	85	283	2.00	0.60
35	1806	2.40	0.60	90	241.8	2.10	0.70
40	1465	2.36	0.60	95	207.1	2.21	0.70
45	1195	2.31	0.60	100	178.0	2.31	0.80
50	980	2.27	0.60	105	153.6	2.42	0.80
55	809	2.23	0.60	110	133.1	2.52	0.90
60	671	2.19	0.60	115	115.7	2.61	0.90
65	559	2.15	0.60	120	100.9	2.68	1.00
70	469	2.11	0.60				

Note: The table only applies between 20°C to 120°C. Temperatures below this range are set to 20°C, and temperatures above this range are set to 120°C.

Table 2: Honeywell NTC Thermistor Temperature vs. Output (Resistance) Table

Temp [Deg C]	Resistance [ohms]	Temp [Deg C]	Resistance [ohms]	Temp [Deg C]	Resistance [ohms]	Temp [Deg C]	Resistance [ohms]
20	1249.5	45	436.6	70	175.2	95	78.8
21	1194.5	46	420.0	71	169.3	96	76.5
22	1142.1	47	404.0	72	163.7	97	74.3
23	1092.3	48	388.6	73	158.3	98	72.1
24	1045.0	49	374.0	74	153.1	99	70.0
25	1000.0	50	360.0	75	148.1	100	68.0
26	957.2	51	346.6	76	143.3	101	66.0
27	916.4	52	333.8	77	138.6	102	64.2
28	877.6	53	321.5	78	134.1	103	62.3
29	840.7	54	309.7	79	129.8	104	60.6
30	805.5	55	298.4	80	125.7	105	58.9
31	772.0	56	287.6	81	121.7	106	57.2
32	740.0	57	277.3	82	117.9	107	55.6
33	709.6	58	267.3	83	114.2	108	54.1
34	680.6	59	257.8	84	110.6	109	52.6
35	652.8	60	248.7	85	107.2	110	51.2
36	626.5	61	239.9	86	103.8	111	49.8
37	601.3	62	231.5	87	100.6	112	48.4
38	577.2	63	223.4	88	97.6	113	47.1
39	554.3	64	215.7	89	94.6	114	45.8
40	532.3	65	208.2	90	91.7	115	44.6
41	511.4	66	201.1	91	89.0	116	43.4
42	491.4	67	194.2	92	86.3	117	42.3
43	472.3	68	187.6	93	83.7	118	41.1
44	545.0	69	181.3	94	81.2	119	40.1
						120	39.0

Note: The table only applies between 20°C to 120°C. Temperatures below this range are set to 20°C, and temperatures above this range are set to 120°C.

Output Specifications

Maximum Current Output (High frequency PWM output)	High side driver 1 output (up to 2A) Solenoid A: 1 proportional or 1 on/off Overcurrent protection is provided Short circuit protection is provided.
Reference Voltage	+5V, 50 mA
Output Current Adjustments	I-max. (specified by user – configurable setpoint in software) I-set (specified by user – configurable setpoint in software) I-min. (specified by user – configurable setpoint in software) All current settings are adjustable from 0 to 2 Amps.
Superimposed Dither	<u>Dither Amplitude:</u> 10% I-max. (fixed) <u>Dither Frequency:</u> (specified by user – configurable setpoint in software) Adjustable from 700-350 Hz
Ramp Rate	Ramps to I-set: (specified by user – configurable setpoint in software) Adjustable from 0-5 seconds.

Configurable Parameters

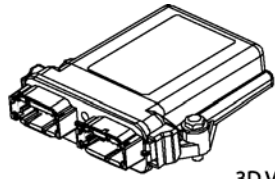
The following table illustrates typical fan control software available on request.

Alternatively, application-specific software can be provided.

Description	Variable Name	Default (Specified when order)	Range (Specified when order)	Unit
Temp. Sensor Type	AI1_type AI2_type AI3_type	NTC NTC NTC	{NTC, PTC_RTD, Delphi, Not_Active}	Enumerator
Temp. Sensor 1 Low	AI1_low	TBA	20-120	°C
Temp. Sensor 1 High	AI1_high	TBA	20-120	°C
Temp. Sensor 2 Low	AI2_low	TBA	20-120	°C
Temp. Sensor 2 High	AI2_high	TBA	20-120	°C
Temp. Sensor 3 Low	AI3_low	TBA	20-120	°C
Temp. Sensor 3 High	AI3_high	TBA	20-120	°C
Analog Input Filter Frequency	AI_ff	60	{50, 60}	Enumerator, Values are in Hz
PWM Input Low	PWM_low	5	0-100	% D.C.
PWM Input High	PWM_hi	95	0-100	% D.C.
PWM Input Type	PWM_type	Normal	{Normal, Reversed, Not_Active}	Enumerator
Input Priority	AI_pri	No_Priority	{TS1, TS2, TS3, PWMI, No_Priority}	Enumerator
% Speed Advance	RPM_adv	TBA	0-100	%
% Speed Retard	RPM_ret	TBA	0-100	%
Invert Output Current (Fan Reverse)	I_inv	TBA	T/F	-
I-set Ramp Time	I_ramp	TBA	0-5	sec
Minimum Current	I_min	TBA	0-2000	mA
Setpoint Current	I_set	TBA	0-2000	mA
Maximum Output Current	I1_max	TBA	0-2000	mA
Fan Reverse Hold Time	t_rev	TBA	0-20	sec

General Specifications

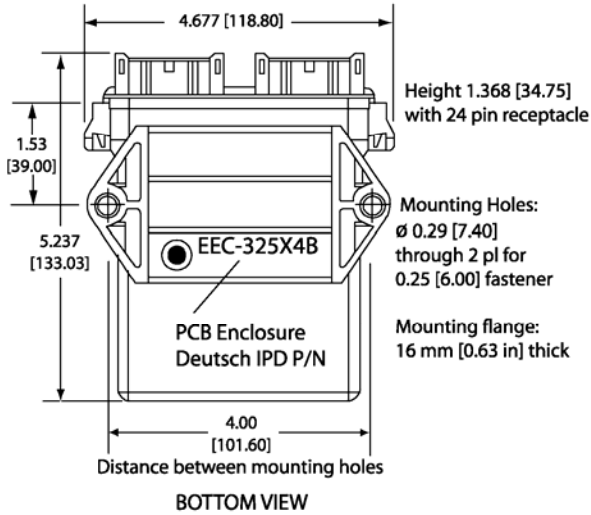
Microprocessor	MC56F8322
Control Logic	Application – specific software provided The controller can be factory programmed with a range of temperatures (minimum and maximum temperature setpoints) or a single temperature setpoint. The priority of the digital inputs is factory programmed.
Interface	RS-232 on-board connection is available for setpoint configuration, software upgrade and diagnostics. RS232 serial communication interfaces to a serial port (i.e. COM1) on a PC (115200 Baud Rate, N81, Xon/Xoff Flow Control) Tera Term or Microsoft HyperTerminal™ or an equivalent data terminal
Electrical Connections	<u>24 pin</u> Deutsch DTM series 24 pin receptacle (DTM13-12PA-12PB-R008) Mating plug: Deutsch DTM06-12SA and DTM06-12SB with 2 wedgelocks (WM12S) and 24 contacts (0462-201-20141). 20 AWG wire is recommended for use with contacts 0462-201-20141. <i>Mating plugs are provided with prototypes only.</i> Use dielectric grease on the pins when installing the controller.
Packaging and Dimensions	High Temperature Nylon housing Deutsch IPD PCB Enclosure (EEC-325X4B) 4.62 x 5.24 x 1.43 inches 117.42 x 133.09 x 36.36 mm (W x L x H excluding mating plug) <i>OEM specific packaging and connection styles are available.</i>
Operating Conditions	-40 to 85°C (-40 to 185°F)
Vibration	Vibration compliance is suitable for mobile equipment applications.
Protection	IP67; Unit is conformally coated within the housing. Plugs carry an IP69 rating.
Weight	Contact Axiomatic.
Mounting	Contact Axiomatic.



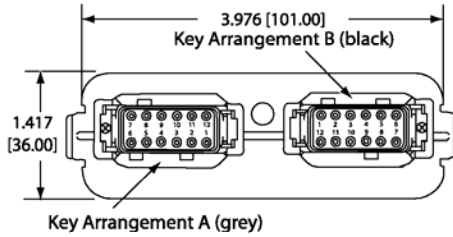
3D VIEW
Housing with 24 Pin Receptacle

HOUSING DIMENSIONS

Housing Material: High Temperature Nylon (Black)



FRONT VIEW 24-PIN RECEPTACLE (NOT TO SCALE)

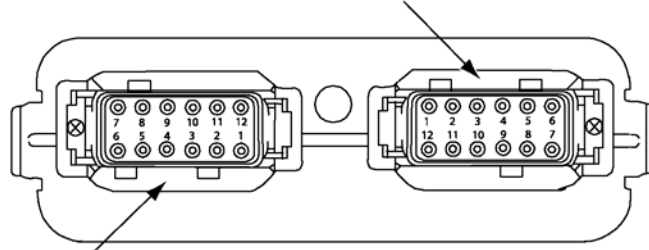


Mating Plug Assemblies for 24-pin receptacle:
Deutsch IPD P/N: DTM06-12SA and DTM06-12SB
with wedgelocks WM12S and contacts
(Contact factory for contact specification.)

Dimensions: inches [mm]
excluding mating plug(s)

Connections (Typical): Refer to installation instructions for a specific part number for actual pin out.

Key Arrangement B (black)



Key Arrangement A (grey)

FRONT VIEW 24 PIN RECEPTACLE

Grey Connector		Black Connector	
Pin #	Function	Pin #	Function
1	+5V Reference (Protected)	1	Temperature Sensor 1
2	Analog Input (Potentiometer)	2	Temperature Sensor 2
3	Analog GND or RS-232 GND (DB-9 Female, pin 5)	3	Temperature Sensor 3
4	Solenoid A-	4	Temperature Sensors' GND
5	Not Used	5	Digital GND or RS-232 GND (DB-9 Female, pin 5)
6	Battery -	6	PWM Input
7	Battery +	7	Digital Input 1
8	Not Used	8	Digital Input 2
9	Solenoid A+	9	Digital Input 3
10	RS-232 Receive (DB-9 Female, pin 3)	10	Digital Input 4 (Manual Mode)
11	RS-232 Transmit (DB-9 Female, pin 2)	11	Not Used
12	Not Used	12	Not Used

RS-232 communications:

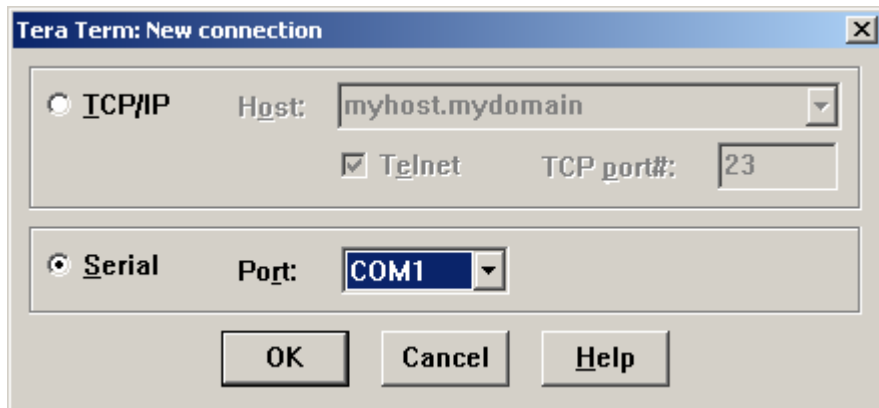
For further details refer to the user manual for the specific part number.

Using a PC and Tera term freeware, the user can select between displaying system parameters, changing system parameters, setting the default values, loading new software and showing the internal state of the controller (diagnostics).

NB. Tera term is freeware and is downloadable from <http://hp.vector.co.jp/authors/VA002416/teraterm.html>.

1. Setting Up PC Communications to the Controller

- Connect an RS-232 to DB-9 cable adaptor to the controller and a PC.
- Use a stable power supply. **With the power supply OFF**, connect the controller Power- to the power supply Ground, and the Power+ to the power supply +.
- Open Tera Term Pro, and set it up as shown below.
(Free downloadable from <http://hp.vector.co.jp/authors/VA002416/teraterm.html>)
- Select Serial with the appropriate COM port.



- Go to Setup/Serial Port and change the settings exactly as shown below.

Tera Term: Serial port setup

Port: **COM1**

Baud rate: **115200**

Data: **8 bit**

Parity: **none**

Stop: **1 bit**

Flow control: **Xon/Xoff**

Transmit delay: **0** msec/char **0** msec/line

OK Cancel Help

- Go to Setup/Terminal and verify that New-line Transmit and Receive are CR.
- Adjust the window size as desired by checking 'Term size = win size'.

Tera Term: Terminal setup

Terminal size: **120** x **50**

☒ Term size = win size

☐ Auto window resize

New-line: Receive: **CR** Transmit: **CR**

Terminal ID: **VT100**

☐ Local echo

☐ Auto switch [VT<->TEK]

Answerback:

OK Cancel Help

2. Configuring the Controller - Main Menu

- To access the main menu for existing software, turn **ON** power to the controller.
- Follow the prompts on the screen to view or to change the configurable parameters.

Specifications are subject to update without notice.
Form: TDAX021500-12/04/07